# M. Tech.(CSE) Programme Structure

## First Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L-T-P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NP1PGCC01</td>
<td>Computational Methods And Techniques</td>
<td>3-1-0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>NP1PGCC02</td>
<td>Internet Of Things</td>
<td>3-1-0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>NP1CSBC03</td>
<td>Branch Specialization Core - I</td>
<td>3-1-0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Advanced Computer Architecture</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>NP1CSBC04</td>
<td>Branch Specialization Core - II</td>
<td>3-1-0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Advanced Data Structure And Algorithm</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>NP1CSBC05</td>
<td>Branch Specialization Core - III</td>
<td>3-1-0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Advanced Operating System</td>
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<tr>
<td>6</td>
<td>NP1CSBL01</td>
<td>Laboratory - I</td>
<td>0-0-4</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>NP1CSBL02</td>
<td>Report Writing &amp; Seminar (Entrepreneurship &amp; Start Up)</td>
<td>0-0-4</td>
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</tbody>
</table>

Total Credits 28

## Second Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L-T-P</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1</td>
<td>NP2CTCC01</td>
<td>Specialization Core - I</td>
<td>3-1-0</td>
<td>4</td>
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<tr>
<td></td>
<td>Computer Graphics</td>
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<tr>
<td>2</td>
<td>NP2CTCC02</td>
<td>Specialization Core - II</td>
<td>3-1-0</td>
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<tr>
<td></td>
<td>Software Engineering</td>
<td></td>
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<tr>
<td>3</td>
<td>NP2CTCC06</td>
<td>Elective – I (Specialization Related)</td>
<td>3-1-0</td>
<td>4</td>
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<tr>
<td></td>
<td>1. Machine Learning</td>
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<td>2. Distributed Database System.</td>
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<td>3. J2EE.</td>
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<td>4. Information Extraction and Retrieval.</td>
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<tr>
<td>4</td>
<td>NP2CTCC09</td>
<td>Elective – II (Departmental Related)</td>
<td>3-1-0</td>
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<tr>
<td></td>
<td>1. Cryptography</td>
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<td></td>
<td>2. Data Ware Housing &amp; Data Mining</td>
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<tr>
<td></td>
<td>3. Embedded System.</td>
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<td></td>
<td>4. Graph Theory.</td>
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<tr>
<td>5</td>
<td>NP2ETCC04</td>
<td>Elective – II (From Any Department)</td>
<td>3-1-0</td>
<td>4</td>
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<tr>
<td></td>
<td>1. Digital Image Processing</td>
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<td></td>
<td>5. Bio Informatics.</td>
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</table>
**Syllabus of M.Tech Computer Science Engineering (2018 Batch)**

### Third Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L-T-P</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1</td>
<td>NP3PGCC01</td>
<td>Research Methodology</td>
<td>3-1-0</td>
<td>4</td>
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<tr>
<td>2</td>
<td>NP3PGCC02</td>
<td>Intellectual Property Rights</td>
<td>3-1-0</td>
<td>4</td>
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<tr>
<td>3</td>
<td>NP3CSBL01</td>
<td>Pre Dissertation Work Evaluation</td>
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</table>

**Total Credits** 17

*Students going for Industrial Project/Thesis will complete these courses through MOOCs.*

### Fourth Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L-T-P</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1</td>
<td>NP4CSBL01</td>
<td>Disseration Evaluation And Open Defence</td>
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<td>17</td>
</tr>
</tbody>
</table>

**Total Credits** 17

*Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.*
Module – I

Module – II

Module – III
Hierarchical Memory Technology: Data and Instruction caches, Multi-level caches, Cache memory mapping policies, Cache Coherence, Cache Performance, Virtual memory, Page replacement techniques, Memory Inter leaving, Memory Management hardware.

Module – IV
Data Flow Computer Architecture: Static Data flow computer, Dynamic Data flow computer, Cluster computers, Distributed computing, Cloud computing.

Reference Books:
2. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann
NP1CSBC04 | Advanced Data Structure And Algorithm | (3-1-0) | 4 Credits

**MODULE-I:**
Heap Structure: Min-Max heap, Leftist heaps, Binomial heaps, Fibonacci heaps, Skew heaps, Lazy binomial heaps, Deap Data structure.

**MODULE-II:**
Search and Multimedia Structure: Binary Search Tree, AVL Tree, 2-3 Tree, B-Tree, B+ Tree, Red-Black Tree, Segment Tree, k-d Tree, Point Quad Trees, R-Tree, TV-Tree.

**MODULE-III:**
Asymptotic Notations, Dynamic Programming (LCS, Floyd-Warshall Algorithm, Matrix Chain Multiplication), Greedy Algorithm (Single Source Shortest Path, Knapsack problem, Minimum Cost Spanning Trees), Geometric Algorithm (Convex hulls, Segment Intersections, Closest Pair), Internet Algorithm (Tries, Ukonnen's Algorithm, Text pattern matching), Numerical Algorithm (Integer, Matrix and Polynomial multiplication, Extended Euclid’s algorithm)

**MODULE-IV:**
Polynomial Time, Polynomial-Time Verification, NP Completeness & reducibility, NP Completeness proofs, Cook’s theorem

**Reference Books:**
NP1CSBC05 | Advanced Operating System | (3-1-0) | 4 Credits

MODULE-I:
System Architecture Types, Distributed Operating Systems, Issues in Distributed operating Systems, Lamport’s Logical Clocks, Vector Clocks, Causal Ordering of Messages, Global State, Chandy-Lamport’s Global State Recording Algorithm,

MODULE-II:

MODULE-III:

MODULE-IV:
Distributed File Systems, Distributed Shared Memory, Distributed Scheduling, Fault Tolerance, Multiprocessor Operating Systems.

Reference Books:
NP1PGCC01 Computational Methods And Techniques (3-1-0) 4 Credits

MODULE-I:
Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.

Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen’s Feature Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.

MODULE-II:

MODULE-III:

Linear Programming: Simplex Method, Duality, Sensitivity Methods

MODULE-IV:

Books Recommended:
1. Neural Networks - by Simon Haykin
2. Fuzzy Logic with Engineering Application - by ROSS J.T (Tata Mc)
3. Neural Networks and Fuzzy Logic – by Bart Kosko
5. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
6. Related IEEE/IEE Publications
10. Gill, Murray and Wright, “Practical Optimization”
12. Song Y., “Modern Optimization Techniques In Power System”
| NP1PGCC02 | **Internet Of Things** | (3-1-0) | 4 Credits |

**MODULE I**

**Introduction to Internet of Things**


**MODULE II**

**Domain Specific IoTs**

**Home Automation**: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities - Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response,

**Environment** - Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection, **Energy** - Smart Grids, Renewable Energy Systems, Prognostics, **Retail** - Inventory Management, Smart Payments, Smart Vending Machines, **Logistics** - Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics, **Agriculture** - Smart Irrigation, Green House Control, **Industry** - Machine Diagnosis & Prognosis Indoor Air Quality Monitoring,

**Health & Lifestyle** - Health & Fitness Monitoring, Wearable Electronics **IoT and M2M Introduction**, **M2M** - Difference between IoT and M2M, **SDN and NFV for IoT** - Software Defined Networking, Network Function Virtualization

**MODULE III**

**IoT Platforms Design Methodology**


**IoT Physical Devices & Endpoints** - What is an IoT Device - Basic building blocks of an IoT Device,

**Exemplary Device**: Raspberry Pi. About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces - Serial, SPI, I2C, **Programming Raspberry Pi with Python** - Controlling LED with Raspberry Pi, Interfacing an LED and Switch with Raspberry Pi, Interfacing a Light Sensor (LDR) with Raspberry Pi, **Other IoT Devices** - pcDuino, Beagle Bone Black, Cubieboard

**MODULE IV**

**IoT&Beyond** - Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet of Everything
Text Books:

Reference Books:
1. The Internet of Things, by Michael Millen, Pearson

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP1CSBL01</td>
<td>Laboratory - I</td>
<td>(0-0-4) 4 Credits</td>
</tr>
<tr>
<td></td>
<td>The concerned instructor will define the experiment list in sync with the theory subject.</td>
<td></td>
</tr>
<tr>
<td>NP1CSBL02</td>
<td>Report Writing &amp; Seminar (Entrepreneurship &amp; Start Up)</td>
<td>(0-0-4) 4 Credits</td>
</tr>
</tbody>
</table>
Second Semester

NP2CTCC01 Computer Graphics (3-1-0) 4 Credits

MODULE-I
Introduction: Display of entities, geometric computation and representation, graphics environments; Working principles of display devices: Refreshing Raster scan devices, vector devices, cathode ray tube terminals, plotters; Display of colors: Look-up tables, display of gray shades, half toning; Display and drawing of graphics primitives: Point, line, polygon, circle, curves, and texts;

MODULE-II
Coordinate conventions: World coordinates, device coordinates, normalized device coordinates, view-port and window, zooming and panning by changing coordinate reference frames; Computations on polygons: Point inclusion problems, polygon filling, polygon intersections, clipping, polygonization of a point set, convex hull computation, triangularization of polygons;

MODULE-III
Transformations in 2D and 3D: Translation, Rotation, Scaling, Reflection; Projection: Perspective and parallel projections, isometric projection, Transformation matrices; Volume and surface representation: Polygonal meshes, parametric curves and surfaces, Cubic and Bi-cubic Splines, Voxels, Octree and Medial axis representation, Sweep representation, surfaces and volumes by rotation of curves and surfaces, Fractal modeling;

MODULE-IV
Hidden surface and Line Elimination: Elimination of back surfaces, Painters’ algorithms, Binary space partitioning tree; Rendering and visualization: Shading model, constant, Gouraud and Phong shading, Ray tracing algorithm, Radiosity computation; Computer animation: Fundamental concepts.

Books:
NP2CTCC02 | Software Engineering | 3-1-0 | 4 Credits

**MODULE-I**

**MODULE-II**

**MODULE-III**

**MODULE-IV**
Object Oriented Analysis: Class: Interface Class, Control Class, Entity Class.Developing Use Case: Use case Element, Description, Case Study (i.e ATM), Class Classification Approach, Noun Phase Approach, Classical Approach, Function Point Approach, Structural Approach, CRC Card.

**Text Book:**
Module-I:
Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation. Linear regression, Decision trees, over fitting.

Module-II:
Instance based learning, Feature reduction, Collaborative filtering based recommendation. Probability and Bayes learning.

Module-III:

Module-IV:
Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning. Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model

BOOKS:
2. Introduction to Machine Learning Edition 2, by EthemAlpaydin
Distributed Database System

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>MODULE-II</td>
<td>Distributed Database design – A framework, the design of database fragmentation, the allocation of fragments. Translation of global queries into fragment queries, query optimization. Distributed Transaction Management – A framework, transaction atomicity, 2-phase commit, concurrency control: foundations, distributed deadlocks, timestamps.</td>
</tr>
<tr>
<td>MODULE-III</td>
<td>Reliability: Basic concepts, commit protocols, consistent view of Network, Detection and Resolution of Inconsistencies, check points and cold restart. Commercial Systems: Tranclem’s ENCOMPASS</td>
</tr>
<tr>
<td>MODULE-IV</td>
<td>Distributed database systems, IBM’s Inter system communication, feature of distributed ingres and Oracle. Heterogeneous databases: General problems – brief study of multibase.</td>
</tr>
</tbody>
</table>

Text Book:
J2EE | 3-1-0 | 4 Credits

**Module-I:**

**Module-II:**

**Module-III:**
Advanced Technologies – Frameworks:

**Module-IV:**
Spring :IOC, dependency Injection , Constructor injection , setter injection ,type, index,name attributes , Collection injection , Bean inheritance, IDRef, Bean aliasing , Bean scopes, Automating,
 Nested bean factories, dependency Check, dependency On, Aware interface, static factory method, Instance factory method, Factory Bean, Method replacement , look up method injection , Properties editors , Internationalizations(I18N), Bean POST Processor , Bean factory POST Processor , Event Factory vs Application Context , Spring AOP, Spring Integration with Hibernate, Spring integration with Struts, Introduction to design pattern.

**Books:**
5. Java 7 JAX-WS Web Services by Deepak Vohra
6. Building a Restful Web Service with Spring by LudovicDewailly
7. Spring in Action by Craig Walls
8. Hibernate in Action by Christian Bauer Gavin King
| Information Extraction and Retrieval | 3-1-0 | 4 Credits |

**Module-I:**
Introduction to Information Retrieval
The nature of unstructured and semi-structured text. Inverted index and Boolean queries.

**Text Indexing, Storage and Compression**

**Module-II:**
Retrieval Models

Performance Evaluation

**Module-III:**
Text Categorization and Filtering

Text Clustering

**Module-IV:**
Advanced Topics
Summarization, Topic detection and tracking, Personalization, Question answering, Cross language information retrieval.

Web Information Retrieval
Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS.

Retrieving Structured Documents
XML retrieval, semantic web

**Textbooks:**
1. Introduction to Information Retrieval, Manning, Raghavan and Schutze, Cambridge University Press, draft.
NP2CTCC09 Cryptography 3-1-0 4 Credits

MODULE-I
Introduction to Cryptography: Basics of Symmetric Key Cryptography, Basics of Assymetric Key Cryptography, Hardness of Functions

MODULE-II
Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations
Formal Notions of Attacks: Attacks under Message Indistinguishability: Chosen Plaintext Attack(IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and INDCCA2), Attacks under Message Non-malleability: NM-CPA and NM-CCA2, Interrelations among the attack model
Random Oracles: Provable Security and asymmetric cryptography, hash functions
One-way functions: Weak and Strong one way functions

MODULE-III
Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)
Building a Pseudorandom Permutation: The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction
Left or Right Security (LOR)

MODULE-IV
Message Authentication Codes (MACs): Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC
Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing
Assumptions for Public Key Signature Schemes: One way functions Imply Secure One-time Signatures Shamir's Secret Sharing Scheme Formally Analyzing Cryptographic Protocols
Zero Knowledge Proofs and Protocols

REFERENCE BOOKS:
Data Ware Housing & Data Mining | 3-1-0 | 4 Credits

**MODULE-I**

**MODULE-II**
Distributed Memory Architecture, Cluster System, Advances in Multiprocessing Architecture, Server Operating System, Operating System Implementation
Data Warehousing Component, Overall Architecture, Data Warehouse Database Sourcing, Acquisition, Cleanup & transformation Tools, Metadata, Access Tools, Data Marts, Data Warehouse Administration and Management, Information Delivery System, Business & Data Warehouse,

**MODULE-III**

**MODULE-IV**
Introduction to Data Mining, Measuring Data Mining effectiveness: Accuracy, speed & Cost, Embedding Data Mining into your Business Process, Discovery verses Prediction, Comparing the Technology, Business Score Card, Application Score Card, Algorithm Score card, Decision Tree, CART, CHAID, Growing the Tree, When does the Tree stop growing, Strength & Weakness, Algorithm Score Card, Neural Network, Different types of neural N/W, Kohonen feature maps, Nearest Neighbor and Clustering, Business Score Card Where to use clustering & nearest neighbor prediction, Clustering for clarity, Clustering for out layer analysis, Nearest Neighbor for prediction, Application Score Card

**Text Books:**
Data Warehousing, Data Mining & OLAP by Alex & Stephen, McGraw Hill.
**Embedded System** | 3-1-0 | 4 Credits

**Module – I (12 Hours)**
Introduction: Features of Embedded systems, Design matrices, Embedded system design flow, SOC and VLSI circuit.
ARM: An advanced Micro Controller, Brief history, ARM pipeline, Instruction Set Architecture ISA: Registers, Data Processing Instructions, Data Transfer Instructions, Multiplications instructions, Software interrupt, Conditional execution, branch instruction, Swap instruction, THUMB instructions. FPGA

**Module – II (12 Hours)**
Devices and device drivers, I/O devices, Serial peripheral interfaces, IIC, RS232C, RS422, RS485, Universal serial bus, USB Interface, USB Connector IrDA, CAN, Bluetooth, ISA, PCI, PCI – X and advance busses, Device drivers.
Real time operating system: Hard real time, firm real time, soft real time, Task periodicity: periodic task, sporadic task, aperiodic task, task scheduling, scheduling algorithms: clock driven scheduling, event driven scheduling.

**Module – III (08 Hours)**
Low power embedded system design: Dynamic power dissipation, Static power dissipation, Power reduction techniques, system level power management.

**Module – IV (08 Hours)**
Hardware and software partitioning: K-L partitioning, Partitioning using genetic algorithm, particle swarm optimization, Functional partitioning and optimization: functional partitioning, high level optimizations. Hardware software co-simulations

**Text Books:**
1. “Embedded System Design ” by Santanu Chattopadhay, PHI
2. “Embedded system architecture, programming and design” By Raj Kamal, TMH
Syllabus of M.Tech Computer Science Engineering (2018 Batch)

Graph Theory  

<table>
<thead>
<tr>
<th>MODULE-I</th>
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<tbody>
<tr>
<td>Basic Concepts: Graphs and digraphs, incidence and adjacency matrices, isomorphism, the automorphism group; Trees: Equivalent definitions of trees and forests, Cayley's formula, the Matrix-Tree theorem, minimum spanning trees; Connectivity: Cut vertices, cut edges, bonds, the cycle space and the bond space, blocks, Menger's theorem; Paths and Cycles: Euler tours, Hamilton paths and cycles, theorems of Dirac, Ore, Bondy and Chvatal, girth, circumference, the Chinese Postman Problem, the Travelling Salesman problem, diameter and maximum degree, shortest paths;</td>
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<tr>
<th>MODULE-II</th>
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<tbody>
<tr>
<td>Matchings: Berge's Theorem, perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, Petersen's theorem, algorithms for matching and weighted matching (in both bipartite and general graphs), factors of graphs (decompositions of the complete graph), Tutte's f-factor theorem;</td>
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<tr>
<th>MODULE-III</th>
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<tr>
<td>Extremal problems: Independent sets and covering numbers, Turan's theorem, Ramsey theorems; Colorings: Brooks theorem, the greedy algorithm, the Welsh-Powell bound, critical graphs, chromatic polynomials, girth and chromatic number, Vizing's theorem; Graphs on surfaces: Planar graphs, duality, Euler's formula, Kuratowski's theorem, toroidal graphs, 2-cell embeddings, graphs on other surfaces; Directed graphs: Tournaments, directed paths and cycles, connectivity and strongly connected digraphs, branchings;</td>
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<tr>
<th>MODULE-IV</th>
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<tr>
<td>Networks and flows: Flow cuts, Max flow min cut theorems, perfect square; Selected topics: Dominating sets, the reconstruction problem, intersection graphs, perfect graphs, random graphs.</td>
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</tbody>
</table>

Text Books:  
2. Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2004.

Reference Books:  
NP2ETCC04 | Digital Image Processing | 3-1-0 | 4 Credits

MODULE-I

MODULE-II
Image restoration, Segmentation: Pixel classification, Bi-level thresholding, Multi-level thresholding, P-tile method, Adaptive thresholding, Spectral & spatial classification, Edge detection, Hough transform, Region growing.

MODULE-III
Matching and Registration: Image modeling, Stereo mapping, Landmark matching, Rectification in geometric transformations, Match measurement, Matching of binary pattern, Distortion tolerant matching; Digital geometry and its applications: Neighborhood, Path, Connectedness, Holes and Surroundness, Borders, Distances, Medial Axis Transform (MAT), Shrinking and Expanding, Thinning.

MODULE-IV

TEXT BOOKS:

REFERENCE BOOKS:
Mobile Computing

MODULE-I

MODULE-II
Wireless LANs: Medium access, Mobile IP routing. TCP over wireless. Mobile ad hoc networking.

MODULE-III
Energy efficiency. Impact of mobility on algorithms and applications.

MODULE-IV

References:
### Syllabus of M.Tech Computer Science Engineering (2018 Batch)

| Wireless Sensor Network | 3-1-0 | 4 Credits |

**MODULE-I**
Introduction: the vision, Networked wireless sensor devices, Applications, Key design challenges.
Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

**MODULE-II**
Synchronization: Issues & Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

**MODULE-III**
Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.
Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols.
Sleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage, Set K-cover algorithms.

**MODULE-IV**
Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing, Routing to mobile sinks.
Data-centric networking: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks.
Reliability and congestion control: Basic mechanisms and tunable parameters, Reliability guarantees, Congestion Control, Real-time scheduling.

**Books:**
Syllabus of M.Tech Computer Science Engineering (2018 Batch)

Computational Finance 3-1-0 4 Credits

MODULE-I
Introduction to Computational Methods in Finance
1- Quick Review of Matrices and Functions (2 Hours, IM) Terminology and definitions — vectors, matrices. Functions of a single variable; differentiability; convexity, concavity; determining minimum or maximum.
Functions of several variables; partial differentiation; gradient; Hessian; Taylor expansion; Newton’s method.
Partial differential equations; finite difference method.
2. Probability and Optimisation (2 Hours, IM) Random variables, probability; distribution, moments. Optimisation.Linear and quadratic programming; feasible set; Lagrangean function; optimality conditions.

MODULE-II
Portfolio Theory and Risk Management
3- Introduction to Investment Theory (2 Hours, NG) basic terminology and definitions — investment, financial markets, cash flows, risk aversion, pricing, hedging fundamental theorems and principals ,interest rate theory — present value, future value
4- Bonds, Stocks and Their Valuation (2 Hours, NG) Valuation of bonds, bond prices, yield to maturity, duration, convexity, term structure, spot and forward rates Valuation of common stocks, stock prices, stock returns and dividend yields.
5- Single-period Markowitz Model (2 Hours, BR) asset return, portfolio return and uncertainty maximum expected value minimum risk — variance, downside risk and may be credit risk, value at risk, Markowitz model- Various versions with different con straints. The efficient frontier.

MODULE-III
6- The Asset Pricing Models: Capital asset pricing modelFactor models-single and multiple factor models. Simple and multiple linear and non linear regression. Derivative Securities:
7- Introduction to Derivatives Financial derivatives-futures, swaps, option contracts (Vanilla, Exotic) Time values of derivatives-arbitrage and risk-neutral valuation.
8- Introduction to Option Theory Models of asset dynamics-binomial lattice, stochastic process, Brownian motion.

MODULE-IV
9- Option Pricing Models Black-Scholes equation and its applications to valuations. Binomial pricing models.

Reference Books:
Bio Informatics | 3-1-0 | 4 Credits

**MODULE-I**
Sequence-alignment methodologies: Sequence databases; Similarity matrices; Pairwise alignment: Features of dynamic Programming, alignment by Bayesian Statistical Methods, multiple sequence alignment: local multiple sequence alignment: MEME, PSSM, HMM( algorithms and applications) Progressive methods for global multiple sequence alignment: CLUSTALW, PILEUP, T-COFFEE; Statistical significance of alignment results;

**MODULE-II**
Pattern analysis in sequences and Phylogenetic tree construction methods: Motif representation, Markov models; Distance Based methods: clustering based methods, optimality based methods: Fitsch -Margoliash and Minimum evolution methods, Neighbor joining and related neighbor methods Character Based methods: Maximum parsimony methods, Maximum likely hood method, genetic algorithm, Phylogenetic tree evaluation: Boot strap analysis; dendrogram and applications .

**MODULE-III**
Structure-Prediction of Biomolecules with applications in Bioinformatics: Structure classification of proteins (SCOP, CATH); Secondary structure prediction of various protein categories (egtransmembrane proteins and helical proteins), RNA secondary structure prediction methods.

**MODULE-IV**
Patterns, motifs and Profiles in sequences: Derivation and search methods; Derived Databases of patterns, motifs and profiles e.gProsite, Blocks, Prints-S, Pfam; Overview of tertiary structure prediction methods; algorithms for modeling protein folding; algorithms for 3D structure prediction with representative examples Protein structure prediction by comparative modeling approaches (homology modeling and fold recognition); ab initio structure prediction methods.
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<th>Code</th>
<th>Course</th>
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<tr>
<td>NP1CTBL01</td>
<td>Laboratory - II</td>
<td>(0-0-4) 4</td>
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The concerned instructor will define the experiment list in sync with the theory subject.

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<td>NP2CTBL02</td>
<td>Design Project</td>
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</table>
Module I:
Introduction to RM: Meaning and significance of research. Importance of scientific research in decision making. Types of research and research process. Identification of research problem and formulation of hypothesis. Research Designs.

Module II:
Measurement and Data Collection. Primary data, Secondary data, Design of questionnaire; Sampling fundamentals and sample designs. Measurement and Scaling Techniques, Data Processing.

Module III:

Module IV:
Data Analysis – II: Factor analysis, Multiple Regressions Analysis. Discriminant Analysis, Use of SPS Package.

Reference Books
1. Research Methodology, Chawla and Sondhi, Vikas
2. Research Methodology, Paneersevam, PHI
NP3PGCC01 | Intellectual Property Rights | 3-1-0 | 4 Credits

Unit 1 - Introduction
Intellectual property: meaning, nature and significance, need for intellectual property Right (IPR), IPR in India – Genesis and development, IPR in abroad, Examples: Biotechnology Research and Intellectual Property Rights Management.

Unit 2 – Copyrights
Copyright: meaning, scope; What is covered by copyright? How long does copyright last? Why protect copyright? Related rights, Rights covered by copyright. Ownership: Duration, Division, Transfer and Termination of Transfers.

Unit 3 – Infringement and Remedies
Literal and non-literature infringement, Role of claims, Doctrines on infringement: Equivalent doctrine, Pith and Marrow doctrine, Comparative test. Defenses: Gillette Defense, General grounds, Patents granted with conditions, Parallel import. Remedies: Civil, Administrative.

Unit 4 – State Law: Trade Secret, Contract, Misappropriation, Right of Publicity
Trademarks, Trade Secret - Overview, Requirements, Misappropriation of Trade Secret, Departing Employees, Remedies, Criminal Liability, Misappropriation, Clickwrap Agreements, Idea Submissions; Right of Publicity, Federal Preemption, Review.

Books:
6. Ajit Parulekar and Sarita D'Souza, Indian Patents Law – Legal & Business Implications; Macmillan India Ltd, 2006
7. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

Reference
1. The Copyright Act, 1957
3. The Trade Marks Act, 1999
4. The Designs Act, 2000
5. The Geographical Indication of Goods Act, 1999
6. The Protection of Plant Varieties and Farmers’ Rights Act, 2001
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<th>Credits</th>
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<tr>
<td>NP3CSBL01</td>
<td>Pre Dissertation Work Evaluation</td>
<td>9</td>
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<tr>
<td>NP4CSBL01</td>
<td>Dissertation Evaluation And Open Defence</td>
<td>17</td>
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**Fourth Semester**